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Trends in forage harvesting technology

Presented here are important technical trends in grass forage harvesting and maize ensiling reflected in the machinery and equipment program at Agritechnica 2001. The preview cannot take the place of a visit to the event and instead only offers preliminary information and does not claim to be comprehensive.

In grass and maize harvesting and ensiling the trend towards approaching the operation as a single procedure from field to silo
- as observed over the past few years – continues. Important, e.g., in grass silage are the points:
- correct mowing time,
- cutting height of 5 to 7 cm,
- reaching dry matter content of 30 to 40% in an as short as possible lying time,
- a planned consecutive swathing and lifting programme, and
- management that recognises the bottleneck of consolidation on the pit as an important quality criterion.

With this background, today's harvesting and lifting machinery is increasingly presented as a complete package for the contractor or machinery ring and also accepted as such by the farmer. Alongside the definite requirement for precise management in silage preparation this approach offers the contractor the possibility of better and more efficient machinery exploitation and thus cost-efficient work. A further element towards securing silage quality which has substantially grown in importance is the use of silage additives.

Mowers

Meeting the need to cut grass at the right time demands high capacity from the mower. Despite the possibility of more precisely steered mowers and surface-following systems with higher mowing speeds, a further increase in area performance with the present technology is only possible through greater working width. Although widths of up to 4.10 m are available with some front and rear mounted mower combinations (disc mower behind), the application of pulled mowers is increasing, especially on large farms.

Pulled mowers, compared with front/rear combinations are more easily operated, they also avoid the need for cost-intensive tractor front hydraulics and pto and give up to 20% greater area performance with the same working width. This performance increase is based especially on the high manoeuvrability of the pulled mower. In the main, pulled mowers with 3.20 working width are used. Greater widths which also offer sufficient contour-following precision can be achieved with several individual mower units mounted in a frame and offering working widths of over 5 m. Through the possible combination of pulled mower with front mower further working width increases are possible. For this scale of pulled mowers to work well on slopes, running gear must feature appropriate tyres.

The largest current working width, and thus area performance, is achieved with three-unit combinations. Alongside the mounted solution for tractors with reverse driving systems, or with the forage harvester acting as tractor, dedicated self-propelled mowers have become more established. Alongside the example from Krone there are now machines in this category from Claas and Vicon, all of them with a capacity of up to 10 ha/h.

As to types of mower (drum, disc), the lower specific weight and power demand of the disc mower, plus its capacity to give a good material transfer to following conditioner, has enabled it to remain dominant. But the drum mower's robustness means this approach has also developed with more working width now available.

More acceptance has been earned by mower conditioners enabling, as they do, reductions in forage lying time. The kinked stems are easily spread by baffles so that wilting can start immediately after the cut. Discussions continue as to whether this approach means swathing before lifting can be omitted without resultant time penalties.

Tedding

Tedding is part of the mowing operation within the silage harvest. Because the swath turner can only work at low speeds (~ 5 km/h) when a consistent height and width of swath is wanted, the increase in area performance to match the mowers is only possible through adding to working width, thus turners are now available with working widths of over 13 m. Implements of this sort of

Fig. 1: The mower combination KM5.90 from Deutz-Fahr in „butterfly" mode (two mowers rear, one front-mounted) gives a working width of. 8.50 m.

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Keywords

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Fig 2: Cardan suspension of the swather-wheels on the Stoll-R 1405 S side windrower allow good adaptability to uneven ground.

width should be applied as pulled equipment. The advantage here is that tractor performance has only to match the pto power requirement, and not the lifting power required for such an implement Whether or not these implements with 10 and more turning wheels can be hydraulically folded into road-going mode thus saving downtime, it is once again clear here why such great efforts are being put into mower conditioning so that this bottleneck in forage preparation can be avoided as much as possible.

Swathing

Swathing is part of the actual forage lifting with swath form and mass as well as area performance being matched so that the period during which the crop lies in the field can be optimally exploited. Sufficient working width is necessary so that enough material is gathered for efficient operation of the lifting/transport machinery. This is why swathers with two rotary tines and with side delivery have established themselves. These have the ability of laying two swaths side by side. The best performing machinery to date is the large-swather featuring four gathering rotary tines and middle swath delivery. The right quality of running gear is required to match working width and speed, with sensor wheels for good surface-following performance.

Loader wagons

The loader wagon has established itself alongside the self-propelled forage harvester with its large transport volume and choppers with up to 45 knives giving a theoretical chop length of 38 mm. Current loader wagons have a volume of over 30 m^3 (DIN) and with a registered total weight of 20 t offer big crop-lifting performance. Helping here is running gear which protects soil from consolidation whilst allowing road speeds of up to 80 km/h. Whether loader wagon or forage harvester is used is often decided on a very regional basis influenced by traffic and field size.

Forage harvester

Engine power of over 440 kW is available with forage harvesters. The cutterheads for maize and grass are appropriately sized (up to 7.5 m working width). Commitment has been given towards weight reduction (through material choice and simplified construction) because of the ever-increasing working widths of forage harvester cutterheads and thresher corn heads. A further criterion for full exploitation of the forage harvester is minimised service and repair downtime through improved operator-friendliness (e.g. automatic cutting height management with corn head, automatic sharpening facilities, electronically adjustable counterblade and uncomplicated adjustment of maize cracker). So that the enormous harvesting capacity of this sort of machine can be matched with forage carting into the silo, the transport volume of silo wagons is on the increase too.

While grass silage harvesting now involves a wide variety of conditioning procedures, the standard maize silage procedure with harvester and corn cracker has remained unchanged. Row-independent corn heads combined with automatic cutterhead height management enables full exploitation of the high-powered forage harvester. Here too, the weak point is the consolidation of the silage in the silo. This means that in this sector too, the giving of individual operations within the forage harvesters to outside labour will give way increasingly to contractors or machine rings taking over the whole procedure.

Round and square balers

Chopping mechanisms with rotational pick-ups are now established with round and square balers. Normally the choppers are equipped with 10 to 24 knives. Especially reduced with the choppers is the over 35 mm stalk length fraction. This means that wilted silage can be consolidated 10 to 15% more with the associated higher dry matter density in bales an important silage quality requirement. A further advantage of chopped material for baling is the easier and more energy-efficient distribution of the material on opening the bale

Fig 3: Wrapping of round and big square bales has developed. A number of exhibitors offer improved labour efficiency through combining baling and wrapping in one machine. Here, the John Deere 678 combination baler which avoids the need for separate wrapping operations in the field.